INDUSTRIAL EDUCATION 10-20-30

ELECTRICITY ELECTRONICS

INDUSTRIAL EDUCATION

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Alberta
EDUCATION

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ACKNOWLEDGEMENTS

Alberta Education acknowledges with appreciation the contribution of the following Ad Hoc Committee members to the preparation of this guide.

INDUSTRIAL EDUCATION 10, 20, 30

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NOTE: This Curriculum Guide is a service publication only. The Senior High School Program of Studies contains the official statement concerning Senior High School courses. The information contained in the guide is prescriptive insofar as it duplicates that contained in the Program of Studies. There are in the Guide, however, as well as content, methods of developing the concepts, suggestions for the use of teaching aids and lists of additional reference books.

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NOTE:

Industrial Education 10, 20 and 30 is made up in four (4) packages according to career fields.

Teachers may select modules from a number of fields and consequently will need those packages that contain the content for the modules they plan to teach.

The packages are color-coded and contain the following career fields:

Electricity-Electronics - yellow

Materials - green

Power Technology - blue

Visual Communications - orange

The general modules of Research, Development and Production Science will be found in each package.

Study the content of the modules carefully and select those that best meet the needs of the students in the school, your own competencies and the availability of tools and equipment.

INTRODUCTION

The Industrial Education 10, 20, 30 series of courses is designed to provide exploration of, and orientation to, a wide variety of career options. These courses provide guidance to students to help them select more in-depth courses for occupational preparation or simply add to their technological "know-how".

Through the program, students are able to work in an environment which is conducive to challenging their intellect and developing their talents in a number of technical and craft areas. Students become aware of the interrelationship and the dependency of one technology upon the others. They have the opportunity to develop an understanding of the principles and skills required in the various occupations. Students will have many opportunities to apply academic skills learned in other subjects to their lab work.

RATIONALE

Industrial Education adds a new dimension to the program for educating young people at the secondary school level. For many students it will provide unique options to help prepare them for the life ahead while enjoying their current studies. The authors of the Industrial Education curriculum recognize that the needs of society have changed, and with them the approach to knowledge acquirement. Students today must be helped to discover how to learn, to conduct inquiry, to study independently, to make choices and decisions, to use technology, and to live with change.

The Industrial Education program is concerned with career development. Because careers today do not develop along predictable lines, our education program must provide considerable flexibility so that students have an option of several career choices. This is possible for several reasons. A person who has been broadly educated is able to learn what he needs to know, within limitations, about a new job. With the general education level of the society rising, the future worker needs broad as well as experience-based education. Such an education offers him/her subsequent chances for rapid and successful specialization. With this in mind the learning experiences should be such that they become the basis upon which specialization can be built.

Our task in the secondary school then, is to provide students not only with entry skills for several careers but to orient the program to meet social and cultural goals. This means that the various courses or disciplines must be interrelated. Industrial Education provides a unique opportunity for the teacher to demonstrate these relationships and further, to capitalize on them by means of the motivation created through practical applications. Thus the experiences to which students are exposed should provide them with realistic criteria for career guidance.

Industrial Education is a program consisting of courses that provide a continuum of experiences, starting with exploratory experiences and activities in the elementary and junior high school, expanding in the high school to the development of skills in career fields and culminating in on-the-job experience.

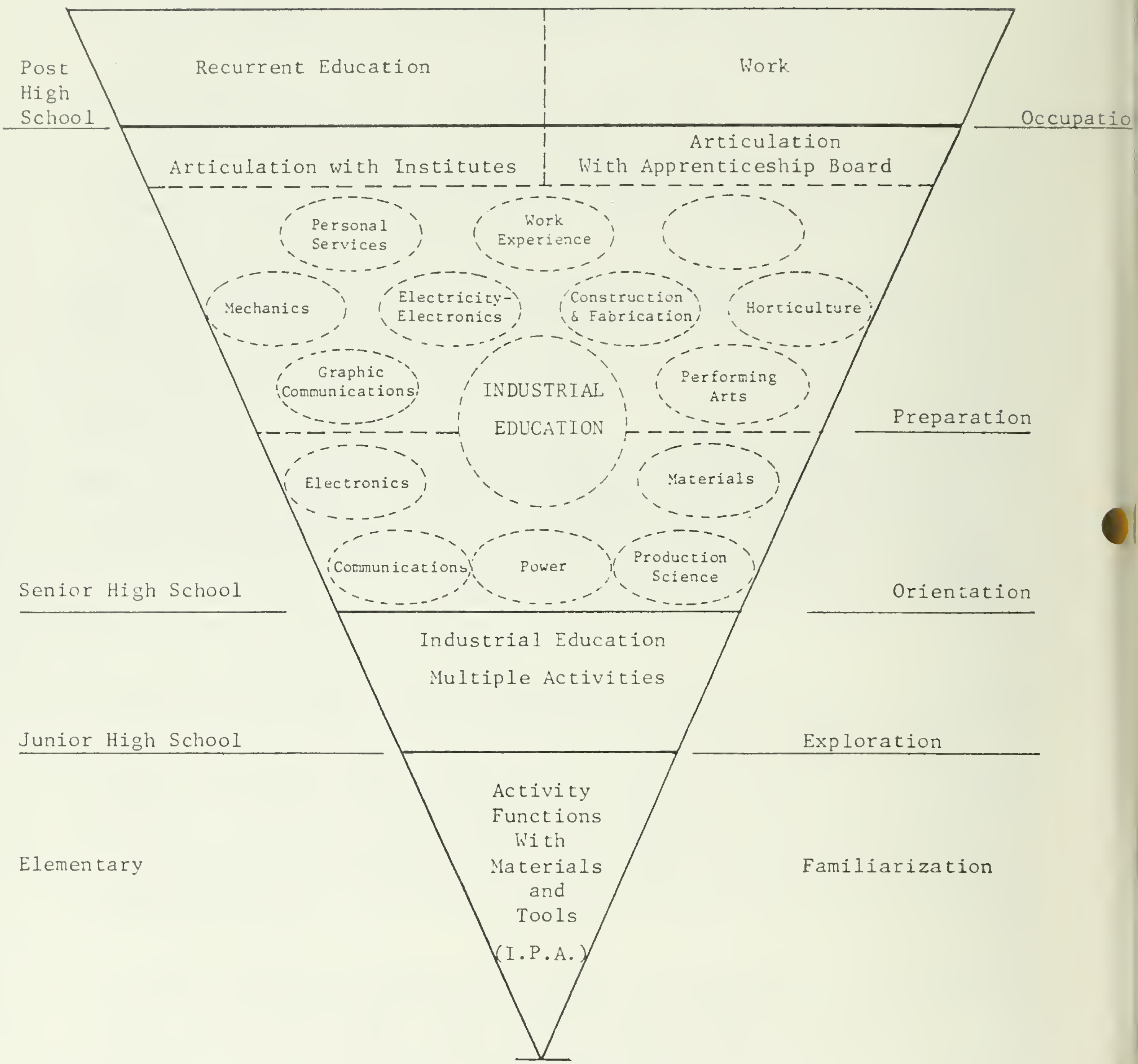
Industrial Education in the Junior High School, the exploratory phase of the continuum, provides the opportunity for the students to explore, reason, experiment and discover the reality of the technological society in which they live. The content of the program deals with industry, its organization, materials, processes, products, occupations, and the problems resulting from the impact of technology on society.

Following the exploratory phase, students may begin orientation studies in a career field. They may select modules of a more general nature in the Industrial Education 10, 20, 30 series or alternately take an introductory 12 course related directly to a career field. From here they advance to the more specific courses in the Industrial Education 22-32 program which prepare them for a career. The chart on the following page illustrates the Industrial Education Program in conceptual form, showing the advancement of a student from the awareness or familiarization stage to exploration, orientation, preparation and finally, an occupation. These courses provide in-depth experiences in the development of skills in tool and machine operation, material processes, drawing and interpretation and a knowledge of the basic concepts related to the technologies. All the courses place emphasis on practical work and applied theory.

ALBERTA INDUSTRIAL EDUCATION PROGRAM

FOR

CAREER CHOICE AND DEVELOPMENT



Legend: ——————— Solid line indicates levels

- - - - - - - - - - Broken lines and open spaces indicate opportunity to transfer to other options

OBJECTIVES OF INDUSTRIAL EDUCATION

The Industrial Education Program can help achieve the Goals of Schooling and Education. The course objectives are more focused and give direction to the teacher.

The objectives of Industrial Education are classified in three areas with the following purposes:

Personal Growth:

To provide opportunities for the individual growth of the student through the development of acceptable personal and social values necessary in a productive society.

1. To provide a technical environment which motivates and stimulates individuals to discover their interests and develop personal and social responsibilities.
2. To assist in the development of positive attitudes toward safety.
3. To assist in the development of positive attitudes toward conservation and environment.
4. To assist in the development of consumer literacy.

Career Exploration:

To develop basic competencies, integrating cognitive and psychomotor skills to enter a family of occupations or post-secondary institutions for further education.

1. To provide exploratory experiences in the use of tools, equipment and materials appropriate to various technologies prevalent in a productive society.
2. To develop an understanding of the interrelationship of various technologies.
3. To provide a technical environment for students to synthesize their accumulated knowledge in the solution of practical problems.
4. To assist the student to develop habits that will be conducive to the establishment of a safe environment.

Occupational Skills:

To develop basic competencies, integrating cognitive and psychomotor skills to enter a family of occupations or post-secondary institutions for further education.

1. To provide safe exploratory experiences in the use of tools, energy, equipment and materials appropriate to various technologies prevalent in a productive society.

2. To develop an understanding of the intrrelationships of various technologies.

3. To provide a technical environment which permits students to synthesize their accumulated knowledge in the solution of practical problems, and to assist students to develop habits that will be conducive to the establishment of a safe environment.

ORGANIZATION

Program Organization:

The Industrial Education 10, 20, 30 courses consist of 56 modules of content. The modules are categorized into career fields. Four career fields, i.e. Graphic Communications, Electricity- Electronics, Materials, and Power Technology have the content of the modules outlined in this guide.

1. Regular Program

   Courses may be created by arranging combinations of modules drawn from the fifty-six available modules. These should be selected carefully to meet the needs of the students while at the same time providing appropriate consideration to factors such as suitability of facilities, equipment availability, supply costs and teacher experience or training. Each course may be taught for 4 or 5 credits (100 - 125 hours). The content for each module may range from 25 - 33 hours. Four modules of 33 hours each would provide the necessary time for a five-credit course. Four 25-hour modules would meet the time requirements for a four-credit course. The selection and sequence of modules is left to the teacher's discretion.

Procedurally, students will register in a course made up of four modules. The first four modules taken by a student would normally be registered as Industrial Education 10A. The next four modules would become 20A and the third set of four modules would be 30A. If some students wished to enrol in further Industrial Education courses, the next course would become 10B, with 20B and 30B following. It would be possible for students to arrange different sequences of courses if it is thought advisable. For example, one sequence might be 10A, 10B, 20A, 30A, 30B; another might be 10A, 20A, 30A, 10B, etc. Sequencing of courses will be left to local authorities. Examples of courses are as follows:

IE 10A (4-5 credits)	IE 20A (4-5 credits)	IE 30A (5 credits)
IE 10B (4-5 credits)	IE 30A (4-5 credits)	IE 30B (5 credits)

2. Special Consideration

In schools where vocational courses are taught, teachers have the option of using content from the "12" courses to make up the 65 hours required as prerequisite to the "22" courses. That is, in a composite high school where unit shops are available, students could be scheduled into two shops for a total of 125 hours, e.g. Auto and Welding. They could then advance to a "22" course in either or both of the courses.

Students in the Industrial Education 10 program would be required to take two modules for 33 hours each, directly related to the "22" course for which they are earning the prerequisite. For example, a student would have entry to a "22" program by taking two closely related modules, plus two others:

e.g. Basic Woods (33 hrs.)
Building Construction (33 hrs.)
Architectural Drawing (33 hrs.)
Basic Wiring (33 hrs.)
Approximate Total 132 hrs. = 1 Industrial Education course (5 credits).

65 hrs. permit entry to
Building Construction 22

Facility Organization

The organization of the physical facilities is in part determined by the original plan. There are, however, adjustments that can be made in the layout by the teacher to accommodate his/her style of teaching. The number of students in the class affects the way the lab or shop is organized. While most of the shops in Alberta are designed for 16 to 20 students, a number of factors must be considered in the final assignment of class load. These factors include:

1. physical size of the shop or laboratory
2. type of student
3. amount of equipment
4. type of programming
5. type of course
6. training and experience of the teacher.

Safety of the student and the opportunity to obtain teacher contact are important considerations when class loads are determined.

EVALUATION

Evaluation of student growth should be based on stated behavioural changes and specific criteria understood by the students. Allowance should be made for both self and teacher evaluation and, in some cases, peer evaluation. Evaluation should be based on the three domains of learning as follows:

Affective	Cognitive	Psychomotor
(Personal Growth)	(Subject matter)	(Product)

MODULE TITLES

The following are the titles of modules in the Industrial Education 10, 20, 30 course.

Electricity-Electronics (yellow package)

1. Basic Electricity and Electronics I
2. Basic Electronics II
3. Equipment Servicing
4. Logic Circuits
5. Computing Systems
6. Introduction to Computers
7. Computer Programming - Introductory

8. Computer Programming - Industrial Applications
9. Communications - Introductory
10. Communications - Systems
11. Electronic Design
12. Electronic Construction

Materials (green package)

1. General Woods
2. Building Construction (Frame)
3. Building Construction (Sub-Trades)
4. Cabinet Construction (Basic)
5. Cabinet Construction (Advanced)
6. General Metals
7. Sheet Metal
8. Machine Metal
9. Arc Welding
10. Oxy-Acetylene Welding
11. Foundry
12. Earths
13. Plastics
14. Textiles
15. Foods

Power Technology (blue package)

1. Conventional Heat Engines
2. Small Engine Repair
3. Small Engine Tune-Up and Troubleshooting
4. Mechanical Systems
5. Non-conventional Power Sources
6. Electrical and Electronic Systems
7. Electro Mechanical and Electronic Control
8. Appliance Repair and Troubleshooting
9. Automobile Maintenance
10. Fluid Power
11. Automobile Tune-up
12. Automobile Repair
13. Automobile Ownership

Visual Communications (orange package)

1. Introduction to Offset Lithography
2. Process Photography - Line
3. Process Photography - Halftone
4. Layout and Design
5. Topographical and Architectural Drafting
6. Relief Printing
7. Screen Process Printing
8. Black and White Photography - Basic
9. Black and White Photography - Advanced
0. Color Photography
11. Mechanical Drafting
12. Customer Service
13. Offset Printing Production

General

Three modules of a general nature also are available. These modules may be used by a student or group only once. These are:

1. Research module
2. Developmental module
3. Production Science module

INTRODUCTION TO ELECTRICITY-ELECTRONICS

Energy in the form of electricity has become very important. Power is basic to our standard of living. With the concern for the efficient utilization of energy, the study of electrical technology takes on increased significance.

There are twelve modules of content which provide the students and teacher considerable choice in building the type of program best suited to the situation. The modules listed may be taught in any order that the teacher finds most appealing.

The major concepts addressed in Electricity-Electronics Technology are:

1. Energy Conversion
2. Energy Control
3. Energy Transfer
4. Energy Utilization

In addition, the nine concepts common to the total program and incorporated in every module where appropriate are:

1. Consumer Awareness

    - quality
    - affective advertising
    - specifications
    - dollar value
    - buying procedures
    - availability
    - parts
    - serving

2. Environmental Implications

    - time element (past, present, future)
    - rates of consumption
    - conservation
    - alternatives
    - pollution (land, air, water)

3. Graphic Interpretation

    - schematic
    - symbols
    - drawing interpretation
    - visuals
    - technical drawing and interpretation

4. Measurement

   - British Engineering System (present English systems)
   - System Internationale (SI)
   - accuracy
   - tools and instruments
   - tolerances
   - precision
   - estimating
   - approximating
   - computations (including graphs, charts, interpolation)

5. Career Information

   - benefits
   - unionism
   - local opportunities
   - job mobility (vertical, horizontal, geographic)
   - future
   - retraining and upgrading
   - jobs vs. careers

6. Societal Implications

   - time (past, present, future)
   - economic
   - life patterns
   - status
   - values and mores

7. Technological Implications

   - costs, benefits, consequences (C.B.C.)
   - resource use and abuse
   - tool development and use
   - manufacturing
   - servicing
   - obsolescence
   - design process
   - planning

8. Safety

   - unsafe conditions
   - unsafe acts.

9. Historical Perspective

   - the historical development of the discipline

COURSE CONTENT

ELECTRICITY-ELECTRONICS

INTRODUCTION

The modules as listed may be selected in the order that the teacher finds most appealing.

Two modules taught for a total of 65 hours will serve as a prerequisite for the appropriate "22" courses in Electricity or Electronics.

OBJECTIVES

The objectives of the modules in Electricity-Electronics are:

1. To make the student aware of a number of ways to convert energy forms and to use various methods of transferring and controlling the converted energy to an intended use.
2. To give the student an opportunity to practise troubleshooting techniques, utilizing analytical thinking.
3. To give the student the opportunity to learn basic binary concepts and logic circuits and study some practical subsystems fundamental to communication, control and computer applications.

LEARNING RESOURCES

*Grob, B. Basic Electronics, McGraw-Hill Ryerson, 1977.

*Malvino, A.P. and Leach, D.P. Digital Principles and Applications, McGraw-Hill Ryerson, 1981.

*Miller, R. and Culpepper, F.W. Energy: Electricity/Electronics, Gage Publishing Co. 1982.

Horn, C. and Poirot, J. Computer Literacy: Problem Solving With Computers, Sterling Swift, 1981.

Robertson, L. Paul Basic Electronics I, Mid American Vocational Curriculum Consortium (MAVCC)

*Refers to prescribed resources.

MODULE ONE

BASIC ELECTRICITY AND ELECTRONICS I

INTRODUCTION

Energy is basic to our industrial society. This module gives students an introduction to basic forms of energy, its conversion to useful work, control transmission and utilization. Electrical theory is studied as necessary for the understanding of the concepts.

OBJECTIVES

The objectives of the Basic Electricity and Electronics I module are to:

1. Introduce the student to the theory of electricity.
2. Introduce the student to the applications of electrical theories.

LEARNING RESOURCES

*Grob, G. Basic Electronics, McGraw-Hill Ryerson.

*Miller, Rex and Culpepper, Fred W., Energy: Electricity/Electronics Gage Publishing Co., 1981.

Robertson, Paul L. Basic Electronics I Mid American Vocational Curriculum Consortium (MAVCC)

*Refers to prescribed resources.

TOPIC 1: SAFETY

GENERALIZATION: Safety is of prime importance to the well being of persons and the protection of equipment.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:	4	O.H. & S. Films.
1. Unsafe Act	- list the consequences of unsafe acts in Electricity-Electronics as they relate particularly to: - live circuits - excessive current - improper grounding - poor connections		O.H. & S. Posters. "Alive Personnel" "Electricity - Handle with Care" film avail. from Power Co.
2. Unsafe Condition	- discuss how to identify conditions which could lead to injuries		
3. Safety Standards and Codes: - Federal - Provincial - Local	- discuss safety standards and codes		IAVEC - ATA Safety Pub. See Unsafe Acts and Conditions
4. First Aid	- study the correct procedure to remove a person from a line and administer artificial respiration - study the symptoms and treatment for a person in shock		IAVAC - ARA Reference to publication on safety. First Aid Films. St. John's Personnel.
5. Safety Program	- participate in the prescribed safety program of the lab and/or school system		Fire Dept. Personnel.

NOTES:

TOPIC 2: DIRECT CURRENT IEEBE

GENERALIZATION: Electrical flow can be controlled, measured and calculated when moving in circuits.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Direct Current:			
- terms	- match terms associated with circuit fundamentals with their correct definitions		
- Coulomb's law	- state and discuss Coulomb's law		
	- select true statements about the relationship of charges according to Coulomb's law		
- Ohm's law	- select true statements concerning the relationship of voltage, current, and resistance according to Ohm's law		
- circuits	- complete a chart of circuit characteristics		
- schematic symbols	- match basic schematic symbols with the circuit elements they identify		
	- identify basic elements in a circuit schematic		
- current flow	- complete a schematic showing current flow		
	- select true statements about open and closed circuits		
	- demonstrate the ability to construct a basic circuit from a schematic		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
2. Scientific Calculations:			
- terms	- match terms associated with scientific calculations with the correct definitions		
- data keys	- match data keys of an electronic calculator with their functions		
- function keys	- match function keys of an electronic calculator with their functions		
- number system	- match the major categories of the number system with the correct definitions		
- systems of numeration	- select true statements concerning systems of numeration		
- scientific notation	- express a large number and a decimal fraction in scientific notation		
- laws of exponents	- state the laws of exponents when multiplying and dividing		
- computations	- arrange in order the operations of computation		
- trigonometry functions	- match trigonometry functions with the correct statements which describe them		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- electronic calculator	- demonstrate the ability to: - use an electronic calculator - solve combined multiplication and division problems - convert numbers between binary and decimal systems - express numbers in scientific and engineering notation - obtain trigonometry function values - determine logarithms of numbers		
3. Resistance:			
- terms	- match terms associated with electrical resistance with their correct definitions		
- resistors	- select true statements about types of fixed resistors - distinguish between the two types of adjustable resistors - select true statements about the composition of fixed resistors - select true statements about the structure of adjustable resistors - select from a preferred resistance value chart resistors that are readily available		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- match resistor symbols and abbreviations with the terms that describe them		
	- state two methods of determining resistor values		
- color code	- discuss the color code four band system		
	- discuss the color code five band system		
	- complete a resistor color chart		
	- compute the value of a resistor using the color chart		
- ohmmeter	- list five parts of an ohmmeter		
	- determine the resistance values from given color codes		
- measurement	- demonstrate the ability to measure circuit resistance with an ohmmeter		
4. Voltage			
- terms	- match terms associated with voltage and measurement with their definitions		
- sources	- name three common sources of voltage		
	- match symbols and abbreviations related to voltage and measurement with their definitions		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- voltmeter	- select principal parts of a typical voltmeter		
	- arrange in order the procedures for using a voltmeter		
- Kirchhoff's law	- state Kirchhoff's law of voltage		
	- discuss current flow in a resistive circuit		
	- discuss polarity in a resistive circuit		
	- state the formulas for voltage drops in resistive circuits		
	- read voltmeter scales		
- measurement	- demonstrate the ability to: - measure and compare the voltage of three different batteries - measure the voltage drops in a DC circuit		
5. Current:			
- terms	- match terms associated with current and measurement with their correct definitions		
	- define prefixes in terms of their numerical decimal equivalents and powers of ten		
	- match symbols and abbreviations relating to current and measurement with the terms they represent		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- measurement	- demonstrate the ability to: - measure and compare current at two points of a circuit - measure and compare current in a circuit at two different voltage levels		
6. Power:			
- terms	- match terms associated with power and measurement to their definitions - match power abbreviations with their correct terms - state three forms of the formula used to compute electrical power		
- wattmeter	- arrange in proper sequence the procedures for power measurement using a DC wattmeter		
- rating	- select true statements concerning resistor wattage rating - distinguish between direct and inverse proportions involved in power formulas		
- measurement	- demonstrate the ability to: - compute current using the power formula - determine the power used in a resistive circuit - determine the function of fuses and resistor power ratings		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
7. Conductors and Insulators:			
- terms	- match terms associated with conductors and insulators with their definitions		
- conductors, semiconductors and insulators	- distinguish between conductors, semiconductors, and insulators - describe four functional features of electrical conductors - describe four functional features of electrical insulators		
- applications	- name major applications of conductors		
- types of material	- name types of wire conductors - select statements that are true about wire sizes and gauge numbers - select statements that are true about the properties of conducting materials - name the desirable properties of conducting materials - select statements that are true about wire resistance - name the desirable properties of wire insulation		
- calculations	- calculate wire diameters, cross-sectional areas, and resistance		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
8. Ohm's law:			
- terms	- match letter designations used in Ohm's law with the correct terms - state Ohm's law - draw the circular expression of Ohm's law - list three uses of Ohm's law		
- calculations	- solve problems for an unknown voltage - solve problems for an unknown current - solve problems for an unknown resistance - demonstrate the ability to use Ohm's law with circuit measurements		
9. Series Circuits:			
- terms	- match terms associated with series circuits with their correct definitions - match abbreviations or symbols with their correct definitions		
- rules	- select true statements concerning rules for series circuits - distinguish between a direct and partial short circuit		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- calculations	- determine total voltage in series circuit		
	- determine voltage drops across resistances		
	- determine total resistance in a series circuit		
	- determine current in a series circuit		
	- determine one unknown circuit value in a series circuit		
	- determine several unknown values in resistive series circuits		
	- compute the power dissipated in a resistive series circuit		
- measurement	- demonstrate the ability to:		
	- measure voltage drops in a series circuit		
	- analyze current values in a series circuit		
	- analyze resistance and power in a series circuit		
10. Parallel Circuits:			
- terms	- match terms associated with parallel circuits with their definitions		
	- select true statements regarding the rules governing voltage in a parallel circuit		

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- select true statements regarding the rules governing current in a parallel circuit		
	- determine the formula to use and the total resistance in given resistive parallel circuits		
- circuit analysis	- perform a circuit analysis of a parallel circuit		
	- select true statements regarding the effect of opens or shorts in parallel circuits		
- measurement	- demonstrate the ability to: - measure voltage, current, and resistance in a parallel circuit - measure power in a parallel circuit		
11. Series-Parallel Circuits:			
- terms	- match terms associated with series-parallel circuits with their correct definitions		
	- match schematic symbols for grounds with their correct definitions		
	- arrange in proper order the steps to simplify a series-parallel circuit		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- select true statements describing the function of ground as a voltage reference		
	- select true statements describing the functions of a voltage divider		
- measurement	- demonstrate the ability to:		
	- measure and calculate quantities in series-parallel circuits		
	- construct a voltage divider and analyze its function		
12. Magnetism:			
- terms	- match terms associated with their correct definitions		
- magnets	- name two types of natural magnets and two types of artificial magnets		
	- name two ways of producing artificial magnets		
	- distinguish between high, medium, low, and nonpermeable magnetic materials		
	- select true statements concerning magnetic lines of force, magnetic fields, magnetic flux, and flux density		
- left hand rule	- discuss the use of the left-hand rules for conductors and coils using an illustration		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES

- induction	- discuss the method and effect of induction
	- list practical applications of induction in the electronics field
	- demonstrate the ability to:
	  - show the existence of magnetic lines of force around a magnet
	  - demonstrate that magnetic poles can attract and repel
	  - construct a simple electromagnet and check its operation		

13. Motors:			
- terms	- match terms associated with motors with the correct definitions		
- magnetic field	- discuss the direction of magnetic field flow surrounding a conductor - select true statements concerning the requirements for motor action		
- torque	- discuss the production of motor torque - list methods of increasing motor torque		
- efficiency	- discuss factors which determine motor efficiency		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- state the formula for determining motor efficiency		
- DC motor	- identify basic parts of a DC motor		
- induction	- determine direction of induced magnetic fields, induced currents, and motor action caused by induction		
- calculations	- calculate motor power and efficiency		
	- match motor torque and electron flow with directional arrows		
	- demonstrate the ability to: - produce motor action from a current-carrying conductor in a magnetic field - calculate horsepower of a small motor		

NOTES:

MODULE TWO

BASIC ELECTRONICS II

INTRODUCTION

Through the activities of this module the student will be able to learn the mystery of electronics using actual test instruments and electrical devices.

OBJECTIVES

The objectives of the Electronics II module are to:

1. Help the student unravel the mystery of electronics.
2. Help the student learn to correctly use test instruments.
3. Familiarize the student with solid state components and circuits.

LEARNING RESOURCES

*Grob, B. Basic Electronics, McGraw-Hill Ryerson, 1977.

*Miller, Rex and Culpepper, Fred W. Energy: Electricity/Electronics, Gage Publishing Co. 1981.

*Refers to prescribed resources.

TOPIC 1: SAFETY IEEE

GENERALIZATION: Safety is of prime importance to the well being of persons and the protection of equipment.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:	4	O.H. & S. Films.
1. Unsafe Act	- list the consequences of unsafe acts in Electricity-Electronics as they relate particularly to: - live circuits - excessive current - improper grounding - poor connections		O.H. & S. Posters. "Alive Personnel" "Electricity - Handle with Care" film avail. from Power Co.
2. Unsafe Condition	- discuss how to identify conditions which could lead to injuries		IAVEC - ATA Safety Pub.
3. Safety Standards and Codes: - Federal - Provincial - Local	- discuss safety standards and codes - perform experiments in compliance with the electrical code		See Unsafe Acts and Conditions IAVAC - ARA Reference to publication on safety.
4. First Aid	- study the correct procedure to remove a person from a line and administer artificial respiration - study the symptoms and treatment for a person in shock		First Aid Films. St. John's Personnel. Fire Dept. Personnel.
5. Safety Program	- participate in the prescribed safety program of the lab and/or school system		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS IEEE

GENERALIZATION: The study of electronics applies concepts to devices made up of discrete components which perform specific functions that can be tested for designed specifications.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Alternating Current:			
- terms	- match terms associated with the nature of alternating current to correct definitions		
- sine wave	- select true statements regarding sine wave relationships		
	- complete a sine wave value conversions chart		
	- match the abbreviations with the correct descriptions of terms relating to alternating current waves		
	- list the formulas used to compute instantaneous values of voltage and current		
	- match sine functions with commonly used values		
- frequencies	- distinguish between audio, sonic, radio, and ultrasonic frequencies		
	- select true statements regarding frequency, period, and wavelength		
	- determine sine wave relationships		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- determine sine wave conversions		
- calculations	- compute instantaneous sine voltage values - compute period and wavelength		
- practical	- demonstrate the ability to construct a sine wave cycle		
2. Rectifiers:			
- terms	- match terms related to rectifiers with their correct definitions		
- waveforms	- sketch the input and output waveforms for a basic half-wave rectifier circuit - state the formulas for the average and peak DC output voltage of a half-wave rectifier		
- identification	- identify a conventional full-wave rectifier and a full-wave bridge rectifier - select true statements concerning the advantages of a full-wave over a half-wave rectifier - state the formulas for the average and peak DC output voltage of a full-wave rectifier		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- determine the DC output voltage of a multiplier circuit		
- calculations	- calculate average DC voltage for half-wave rectifier and full-wave rectifier circuits - indicate the direction of current flow in a full-wave bridge rectifier and a conventional full-wave rectifier		
- practical	- demonstrate the ability to: - construct and test a half-wave rectifier circuit - construct and test a full-wave bridge rectifier circuit - construct and test a voltage doubler circuit		
3. Semiconductor Diodes:			
- terms	- match terms related to special semiconductor diodes with their correct definitions		
- schematics	- select the schematic symbol for a zener diode		
- zener diode	- identify the operating point, the zener voltage, the forward-bias region, the zener current, and the reverse-bias region of a zener diode - list the alternate names for zener diodes		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- select applications of zener diodes		
- tunnel diode	- select the schematic symbol for a tunnel diode		
	- identify the negative resistance region, peak point, valley point, and the forward point of a tunnel diode		
	- select applications of tunnel diodes		
- varactor	- select the schematic symbol for a varactor diode		
	- complete statements concerning bias voltage and barrier capacitance in varactor diodes		
	- list alternate names for varactor diodes		
	- select applications of varactor diodes		
- light emitting diode (LED)	- select the schematic symbol for a light-emitting diode		
	- complete statements concerning instantaneous-forward current versus light output in light-emitting diodes		
	- select applications of light-emitting diodes		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
4. Transistors:			
- terms	- match terms related to bipolar-junction transistors with their correct definitions - match transistor terms with their standard abbreviations		
- elements	- identify the basic elements in PNP and NPN transistor block diagrams and schematics		
- uses	- select the major uses of transistors		
- NPN and PNP	- state the base to emitter forward voltage drop for germanium and silicon transistors - identify the correct biasing arrangements for PNP and NPN transistors - draw the electron flow in NPN and PNP transistor circuits - distinguish between the typical types of transistors		
- circuit	- label a transistor circuit		
- testing	- demonstrate the ability to test transistors		
- photo diode	- select the schematic symbol for a photo diode		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- complete statements concerning light-input intensity versus current in photo diodes		
	- list three applications of the photo diode		
- zener diode	- demonstrate the ability to: - construct a volt/ampere characteristic curve for a zener diode - construct and test a zener diode voltage regulator		
5. P-N Junction:			
- atomic structure	- match terms related to the nature of matter and the P-N junction with their correct definitions		
	- label the nucleus, protons, neutrons, electrons, and the valence shell of an atomic model		
	- match types of bonding with their materials		
- identification	- identify semiconductor crystal structures		
- polarity	- state the majority and minority carriers and their electrical polarity in N-type and P-type semiconductors		
- manufacturing methods	- complete a list of four methods and techniques used to manufacture a P-N junction		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- junctions	- sketch a P-N junction and label the P material, the N material, the depletion region, and the barrier potential showing voltage ranges for the silicon and germanium diodes		
- biasing	- label the proper polarity for a reverse-biased P-N junction and a forward-biased P-N junction		
- schematics	- draw the schematic symbol for a diode, label the cathode, the anode and show the electrical polarity of each terminal to forward bias the device - identify, from the P-N junction diode characteristic curves, the forward-bias region, the reverse-bias region, the majority carriers, and the minority carriers		
- semi-conductor diodes	- demonstrate the ability to: - perform a static test on semiconductor diodes - test a semiconductor diode and plot the characteristic curves		
6. Capacitive Reactance:			
- terms	- match terms associated with capacitive reactance with their correct definitions		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- symbols	- match symbols associated with capacitive reactance with their correct meanings		
- formulae	- state the formula for computing capacitive reactance		
	- list two factors that are inversely proportional to capacitive reactance		
- relationships	- select true statements indicating the relationships between current and voltage in RC circuits		
	- compute the applied voltage, impedance, and power factor of an RC circuit when given the resistive voltage, the capacitive voltage, and the current		
- power	- distinguish between true power, apparent power, reactive power, and the power factor		
- calculations	- state the fomula for computing the figure of merit, or Q, of a capacitor when series resistance is known		
	- compute capacitive reactance		
	- determine phase relationships in RC circuits		
	- compute values of RC circuits		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- capacitance and impedance	- demonstrate the ability to: - show the effect of capacitive reactance in AC circuits - determine capacitive reactance and impedance in RC circuits		
7. Capacitance:			
- terms	- match terms associated with capacitance - match symbols associated with capacitance		
- function	- discuss the functions of capacitors		
- construction	- describe the construction of a capacitor		
- formulae	- state the formula for computing capacitance - state the formula for calculating the total capacitance in parallel circuits - state the formula for calculating the total capacitance when unequal and equal value		
- types	- list the types of capacitors		
- color coding	- discuss the color code system of identification - complete a capacitor color code chart		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- compute the value of a capacitor using the color chart		
- practical	- test capacitors with an ohmmeter		
	- examine the construction of a capacitor		
	- determine the effect of AC and DC on capacitors		
8. RC Time Constant:			
- terms	- match terms associated with RC time constants with their correct definitions		
	- complete statements concerning charging an RC circuit by referring to an illustration		
	- match illustrations of wave-shapes during the charge of an RC circuit with the values they reflect		
	- complete statements concerning discharging an RC circuit by referring to an illustration		
	- match illustrations of wave-shapes during discharge of an RC circuit with the values they reflect		
- time constant	- state the formulas for computing time constant		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- measurement	- list the units of measurement of the horiontal and vertical axes on a universal time constant chart - list units of measurement in the exponential formulas for voltage across a capacitor and voltage across a resistor in an RC circuit when the formulas are given - list units of measurement in the exponential formula for the charge current of an RC circuit when the formula is given - list units of measurement in the exponential formula for the voltage across a resistor during discharge of an RC circuit when the formula is given - review series RC and RL circuit characteristics		
- calculations	- compute RC time constants		
- practical	- demonstrate the ability to: - determine time constants of RC circuits - construct a neon bulb flasher		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
9. Series RCL Circuits:			
- terms	- match terms associated with series RCL circuits with the correct definitions - match the reactance in a series RCL circuit with the circuit condition		
- impedance	- select true statements regarding impedance in series RCL circuits - state the formula for computing impedance in a series RCL circuit - match voltages with their relationship to the current in a series RCL circuit		
- formulae	- state the formula for computing the applied voltage in terms of voltage drops		
- resonant circuits	- list conditions existing in a resonant series RCL circuit - state the formula for computing resonant frequency		
- tuned circuits	- differentiate between resonant frequency variation with respect to capacitance and inductance in a tuned series RCL circuit		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMNTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- select true statements regarding the Q of a series tuned circuit		
- bandwidth	- state the formula for bandwidth		
- calculations	- solve for reactance - solve for impedance - solve for parameters of resonant circuits - compute power in reactive circuits - compute the Q of inductors - solve time constant problems		
- practical	- demonstrate the ability to: - determine resonance in a series RCL circuit - show the effect of inductance in AC circuits - solve for values of an operating RL circuit		
10. Parallel RCL Circuits:			
- terms	- match terms associated with parallel RCL circuits with the correct definitions - select true statements concerning voltage and currents in a parallel RCL circuit		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- formulae	- state the formula for computing total current in a parallel RCL circuit - state the formula for computing impedance in a parallel RCL circuit - select true statements relating to resonance in parallel RCL circuits - state the formula for computing the resonant frequency of a parallel RCL circuit		
- tuned circuits	- select true statements relating to tuned parallel RCL circuits - select true statements relating to the Q of a parallel tuned circuit		
- bandwidth	- state the formula for bandwidth of a parallel RCL circuit		
- resonant circuits	- complete a chart of characteristics of series and parallel resonant circuits		
- calculations	- solve problems related to RL and RC parallel circuits - solve problems related to parallel RCL circuits		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- analysis	- analyze a parallel resonant circuit		
- resonant frequency	- demonstrate the ability to determine the resonant frequency of an RCL parallel circuit		
11. Inductance:			
- terms	- match terms associated with inductance with their correct definitions		
	- match inductance unit abbreviations with their correct definitions		
- self inductance	- discuss factors contributing to self-inductance		
- Lenz's Law	- select true statements concerning Lenz's Law		
	- state the formula for a henry		
- inductance in a coil	- list three factors that affect the amount of inductance of a coil		
	- identify kinds of inductors		
- formulae	- state the formulas for total inductance of inductors connected in series and inductors connected in parallel		
	- list two factors that determine mutual inductance		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- state formulas for mutual inductance, mutual inductance aiding, and mutual inductance opposing		
- transformer	- select true statements about transformer ratios - demonstrate the ability to determine transformer ratios		
12. Inductive Reactance:			
- terms	- match terms associated with inductive reactance with their correct definitions		
- symbols	- match symbols concerning inductive reactance with their correct definitions		
- factors	- list three factors needed to compute inductive reactance		
- formulae	- state the formula for computing inductive reactance - select true statements describing current and voltage relationships in RL circuits - compute the applied voltage and impedance in a series RL circuit - state three formulas for determining true power - state three formulas for determining apparent power		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- state three formulas for determining reactive power		
	- state four formulas for determining power factor		
	- state the formula for determining quality factor (Q) or figure of merit of an inductor		
- inductive time constant	- select true statements concerning inductive time constants		
	- complete the labels on a universal time constant chart		
- calculations	- compute inductive reactance		
	- compute applied voltage and impedance of RL circuits		
	- show the effect of inductance in AC circuits		
	- solve for values of an operating RL circuit		
13. AC Generation:			
- terms	- match terms associated with AC generation with their correct definitions		
	- select true statements concerning electromagnetic induction		

NOTES:

TOPIC 2: ELECTRONIC CONCEPTS, COMPONENTS AND INSTRUMENTS (continued) IEEE

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- generator	- select requirements for generating voltage electromagnetically - discuss the left hand generator rule - select true statements concerning the magnitude of generated voltage - select true statements concerning elementary cycle generation - discuss generator construction using an illustration - state two rules concerning DC generator construction		
- phasors	- select true statements concerning voltage phasors or vectors		
- phase angle diagrams	- select true statements concerning phase angle diagrams - discuss elements of three-phase power generation - determine current flow direction		
- calculations	- compute AC cycle instantaneous values		
- practical	- demonstrate the ability to: - construct a simple generator - identify generator components		

MODULE THREE

EQUIPMENT SERVICING

INTRODUCTION

Servicing and trouble shooting are closely associated but the trade differentiates between the two. Trouble shooting is the use of various instruments in a logical sequence to determine what is wrong with an apparatus. Servicing requires the determination of the fault and then repairing or replacing the defective parts. The process involves disassembly, replacement or repair, reassembly and testing.

OBJECTIVES

The objectives of the Equipment Servicing module are to:

1. Give the student practice in trouble shooting procedures,

2. Give student practice in servicing some electronic equipment.

LEARNING RESOURCES

*Grob, B. Basic Electronics, McGraw-Hill Ryerson, Latest Edition.

*Miller, Rex and Culpepper, Fred W. Energy: Electricity/Electronics, Gage Publishing Co. 1981.

*Refers to prescribed resources.

TOPIC 1: SAFETY IEES

GENERALIZATION: Safety is of prime importance to the well being of persons and the protection of equipment.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:	4	O.H. & S. Films.
1. Unsafe Act	- list the consequences of unsafe acts in Electricity-Electronics as they relate particularly to: - live circuits - excessive current - improper grounding - poor connections		O.H. & S. Posters. "Alive Personnel" "Electricity - Handle with Care" film avail. from Power Co.
2. Unsafe Condition	- discuss how to identify conditions which could lead to injuries		IAVEC - ATA Safety Pub.
3. Safety Standards and Codes: - Federal - Provincial - Local	- discuss safety standards and codes - perform experiments in compliance with the electrical code		See Unsafe Acts and Conditions IAVAC - ARA Reference to publication on safety.
4. First Aid	- study the correct procedure to remove a person from a line and administer artificial respiration - study the symptoms and treatment for a person in shock		First Aid Films. St. John's Personnel. Fire Dept. Personnel.
5. Safety Program	- participate in the prescribed safety program of the lab and/or school system		

NOTES:

TOPIC 2: SERVICING ELECTRICAL AND ELECTRONIC EQUIPMENT IEES

GENERALIZATION: The many electrical and electronic devices being used in our society require replacement parts and periodic repair by a person skilled in diagnosis, dismantling and assembly techniques.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Safety Components:			
- fuses	- describe the various fuses used in electrical circuits		
- circuit breakers	- describe the various circuit breakers used in electrical circuits		
- automatic shut off	- describe the automatic shut off circuit		
	- discuss the advantages and disadvantages associated with each of the safety components described		
2. Test Equipment:			
- multimeter	- use a multimeter to measure resistance, AC and DC voltages, AC and DC currents		
- oscilloscope	- use an oscilloscope to observe waveforms in various parts of a transistor radio or similar system		
- signal generators	- use a signal generator as an input device for a radio or equivalent		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- testers	- use transistor tester, capacity tester, impedance tester and other test instruments available		
3. Tools	- use the available hand tools in dismantling and assembling equipment - protect easily damaged parts and trim using tape - use parts bags to store screws and hardware which are easily lost or misplaced - dismantle a piece of working equipment and reassemble - test the equipment and make any adjustments necessary to make it work properly - clean and restore a piece of electronic equipment - use available soldering equipment to correctly separate and attach soldered connections		
4. Components:			
- identification	- dismantle an old piece of electronic equipment, e.g. radio, and sort the parts into various categories		

NOTES:

TOPIC 2: SERVICING ELECTRICAL AND ELECTRONIC EQUIPMENT (continued) IEES

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- discuss how the components are identified using color coding and numbering systems		
5. Schematics	- use schematic diagrams and identify the symbols used for various components - study schematics and draw boxes around various units in the system		
5. Repair	- use trouble shooting techniques and available equipment and tools to repair a malfunctioning electronic appliance		

NOTES:

MODULE FOUR

LOGIC CIRCUITS

INTRODUCTION

This module covers digital logic based on the logic family of integrated circuits. It is designed to familiarize the students with basic logic gates and provide an introduction to large scale integrated circuits used in various related technologies.

OBJECTIVES

The objectives of the Logic Circuits module are to:

1. Familiarize the student with the digital logic field of electronics.

2. Give the student the opportunity to learn basic binary concepts and logic circuits and study some practical subsystems fundamental to communications, control and computer applications.

LEARNING RESOURCES

*Malvino, A.P. and Leach, D.P. _Digital Principles and Applications_, McGraw-Hill Ryerson, 1981.

Tokheim, R.L. _Digital Electronics_, McGraw-Hill Ryerson, 1981.

Pasahow, E.J. _Microprocessors and Microcomputers for Electronic Technicians_, McGraw-Hill Ryerson, 1981.

Ward, B. _Boolean Algebra_, Howard W. Sams & Co. Inc., 1981.

*Refers to prescribed resources.

GENERALIZATION: In digital logic it is necessary to develop a fundamental understanding of the digital concepts involving the AND, OR and NOT gates and the exclusive OR, NAND and NOR gates.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Gates:			
- identification	- match terms related to logic devices with their correct definitions		
	- identify the schematic symbols for the following gates: - AND - OR - NAND - NOR - exclusive OR - NOT		
- truth tables	- complete truth tables for the most common logic devices		
- circuits	- construct and test an IC "AND" gate circuit		
	- construct and test an IC "OR" gate circuit		
	- construct and test an IC "NAND" gate circuit		
	- construct and test an IC "Exclusive-OR" gate circuit		
	- construct and test a diode "AND" gate circuit		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- construct and test a diode-transistor "NOR" gate circuit		
2. Numbering Systems:	- write the general expression for any numbering system using the notation of the decimal system and substitute, in the expression, the correct constants for the following systems: - binary - octal - hexadecimal		
	- convert a mixed number in one system to an equivalent number in any other numbering system		
- arithmetic functions	- solve arithmetic problems involving addition, subtraction, multiplication, and division in all four numbering systems: - decimal - binary - octal - hexadecimal		
3. Boolean laws and theorems	- identify and define Boolean algebra variables, operators, identities, expressions, laws and theorems		
	- apply Boolean laws and/or theorems when reducing or rewriting Boolean expressions		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
4. Logic Gates:			
- combinational circuits	- using knowledge of Boolean algebra and basic gate theory, design, draw circuits and construct, using NAND gates only, combinational circuits for the following: - AND gate - OR gate - exclusive OR gate		
- practical circuits	- using knowledge of Boolean algebra, develop the circuit diagram, build, using NAND gates only, an electronic circuit based on an English statement		
- multivibrators	- identify multivibrators given their input and output signal waveforms - construct and test the following flip-flops: - R/S - J/K - other		
- shift registers	- construct and test a four-bit shift register		
- counters	- match terms, construct and complete truth tables for: - basic ripple counter - modulus counter - synchronous counter - MSI counter units - MSI shift register and transfer register units		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
- multiplexers	- explain the operation of a typical multiplexer		
- timer	- explain the operation of the 555 timer or equivalent - describe various circuits used for the 555 timer or equivalent		

NOTES:

MODULE FIVE

COMPUTING SYSTEMS

INTRODUCTION

The methods by which computers perform their functions should be understood, by the user, in order that they may be fully utilized.

OBJECTIVES

The objectives of the Computing Systems module are to:

1. Help the student understand how digital computers perform functions.
2. Help the student understand how analog computers process information.

LEARNING RESOURCES

Pasahow, E.J. Microprocessors and Microcomputers for Electronic Technicians, McGraw-Hill Ryerson, 1981.

GENERALIZATION: Experimentation with computing systems should help the user to understand how complicated operations can be performed quickly and accurately.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Digital Computers	- perform various experiments on an 8080 based experimenter board (or equivalent) which include: - input and output devices - CPU - memory		
2. Analog Computers	- perform experiments with operational amplifiers to: - add two quantities - subtract two quantities - multiply two quantities - divide two quantities - integrate a quantity - differentiate a quantity		
	- use the analog computer for practical problems such as: - falling bodies - simple ball and spring - bouncing ball		
3. Analog to Digital Conversion	- discuss the processes by which analog information may be converted to digital form		
	- experiment with voice recognition or similar processes		
4. Digital to Analog Conversion	- discuss the processes involved in computer synthesized music or a similar process		

NOTES:

MODULE SIX

INTRODUCTION TO COMPUTERS

INTRODUCTION

The escalation in the use of computers is making it necessary for one to obtain an understanding of their operation and a knowledge of the common applications. This module gives a general overview of computers and how they are utilized in our society.

OBJECTIVES

The objectives of the Introduction to Computers module are to:

1. Help the student become aware of several uses of the computer.
2. Help the student become familiar with basic computer concepts.
3. Introduce the student to simple computer programming.

LEARNING RESOURCES

Crawford, Tim Basic Computing: A Complete Course, McGraw-Hill Ryerson, 1980.

Dwyer, T. and Critchfield, M. Basic and the Personal Computer, Addison-Wesley.

Dwyer, T. and Critchfield, M. A Bit of Basic, Addison-Wesley, 1981.

Horn, C. and Poirot, J. Computer Literacy: Problem Solving with Computers, Sterling Swift, 1981.

TOPIC 1: COMPUTERS

GENERALIZATION: An understanding of the architecture of the computer provides the basis for the study of the operation of the machine.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
1. Uses:	The student will:		
- introduction	- use the keyboard to: - obtain directory listing - load and run a program - interrupt a program and obtain another selection		
- home	- use a prepared program for home records, such as a financial record - discuss how the computer may be used for recreation, such as games - discuss how the computer can be utilized to control and monitor lights and appliances		
- educational	- use prepared programs for: - drill and practise - simulation - tutorial - problem solving - testing		
- industrial	- discuss how the computer is used in the following applications: - drafting - printing - numerical control		

NOTES:

TOPIC 1: COMPUTERS (continued) IEEC

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- electromechanic control: - lathe - lights - motors - other equipment - process control		
2. Types:			
- analogue	- explain how the analogue computer works		
- digital	- explain how digital computers work		
3. Terminology: - terms	- discuss the meaning of the following terms as they relate to digital computers: - RAM - ROM - PROM - EPROM - MPU - CPU - bit - byte - VDM - CRT - series - parallel - ASC II - DOS		
4. Computing Systems	- discuss the components of a computing system: - computer - input/output device - mass storage device		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- describe the main components of the computer and how they operate: - Central Processing Unit (CPU) - memory (RAM and ROM) - input/output devices; keyboards, CRT's, printers		
	- discuss the use of discs and tapes for the storage of information		
5. Classes:	- discuss computer capabilities with attention to speed and accuracy		
- main frame	- discuss the main frame computer concept and describe the type of service it is able to provide the customer		
- mini	- discuss the differences between the main frame and the mini-computer		
- micro	- discuss the capability of the micro-computer		
6. Technical History	- trace the development of the computer from the earliest time with attention to the following technological developments: - abacus - vacuum tube - transistor - integrated circuit - silicon chip		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
7. Computer Language:			
- machine	- discuss how the computer uses machine language written in binary digit form to understand directions from the user		
- high level (basic)	- discuss the use of BASIC as the high level language used by many computers		
8. Modes of Operation:			
- immediate	- use the computer in the immediate mode to perform arithmetic calculations, such as: addition, subtraction, multiplication and division		
- deferred	- write a simple program using line numbers which will illustrate the storage of instructions for future execution		
9. Flow Charting	- discuss the use of flow charts in the graphic representation of operations - use accepted symbols and flow chart operations, such as: - crossing the street - preparing a cup of coffee		
10. Purchasing	- discuss the purchase of computer equipment with attention to: - main computer capacity - optional equipment - software available		

NOTES:

MODULE SEVEN

COMPUTER PROGRAMMING - INTRODUCTORY

INTRODUCTION

A knowledge of computer programming is becoming necessary in a wide variety of occupations. This module will introduce the student to a simple computer language commonly used in micro-computers.

OBJECTIVES

The objective of the Computer Programming - Introductory module is to:

1. Give the student an elementary knowledge of computer programming.

LEARNING RESOURCES

Crawford, Tim Basic Computing: A Complete Course, McGraw-Hill Ryerson, 1980.

Dwyer, T. and Critchfield, M. Basic and the Personal Computer, Addison-Wesley.

Dwyer, T. and Critchfield, M. A Bit of Basic, Addison-Wesley, 1981.

TOPIC 1: PROGRAMMING - INTRODUCTORY IEEIP

GENERALIZATION: The language understood by the computer is written in code form.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Introductory Procedures	- use the computer to: - obtain directory listing - load and run a program - interrupt a program and obtain another selection - use prepared programs for: - drill and practice - simulation - tutorial - problem solving - other		
2. Language	- discuss the common language used by the micro-computer, such as: BASIC		
3. Modes of Operation	- describe the two commom modes of operation: - immediate - deffered		
4. Arithmetic Operations	- use the micro-computer to perform a number of operations in the same equation		
5. Statements or Commands	- use the following statements in simple programs: - end - stop		
6. Variables	- discuss what is meant by numeric variables - discuss what is meant by string variables		

NOTES:

TOPIC 1: PROGRAMMING - INTRODUCTORY (continued) IEEIP

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- use numeric and string variables in simple programs		
	- discuss how to assign values to variables		
	- discuss how to use variables in a print statement		
7. Input	- discuss the use of input and get statements		
8. Storage	- discuss the process and use the micro-computer to save programs on a disk		
9. Branching:			
- unconditional	- describe the use of the GOTO statement		
- conditional	- describe the use of the IF THEN statement		
	- describe the meaning of the following relational symbols: < , <=, >=, > , <>.		
	- practise using all of the above in simple programs		
10. Loops	- discuss how to use for next loops		
	- discuss how to nest loops		
	- practise writing and running simple programs containing loops		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
11. Flow Charting	- write a computer program given a simple flow chart and brief instructions - complete a flow chart from a simple computer program - draw a flow chart for a given task		
12. Programming	- write and run programs which contain a combination of: - arithmetic operations - statements and commands - variables (numeric and string) - branches (unconditional and conditional) - loops - symbols		
13. Graphics	- discuss how to: - control the cursor on the screen - plot x, y positions on the screen - use other graphic features of the computer - use the graphic features on the micro-computer		
14. Editing	- discuss and use the editing features on the machine available		
15. Disc Operation	- delete a program from a disc - use special disc operations specific to the machine being used		

NOTES:

TOPIC 1: PROGRAMMING - INTRODUCTORY (continued) IEEIP

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	- use the file feature specific to the machine being used		
16. Input	- use the computer to input data using; read, data and restore statements		
17. Advanced Branching	- discuss and use subroutines, such as: gosub and return statements		
	- discuss and use the: on goto and on gosub statements		
18. Functions - numeric	- use some of the following numeric functions: ABS, ATN, COS, EXP, INT, LOG, RND, SGN, SIN, SQR, TAN		
- string	- use some of the following string functions: ASC, CHR$, INSTR, LEFT$, LEN, MID$, RIGHT $, STR$, VAL		
	- describe how to define functions		

NOTES:

MODULE EIGHT

COMPUTER PROGRAMMING - INDUSTRIAL APPLICATIONS

INTRODUCTION

To use the micro-computer effectively to manipulate data and control external equipment the computer must be directed using a language it understands.

OBJECTIVES

The objectives of the Computer Programming - Industrial Applications module are to:

1. Help the student understand the computer operation.
2. Provide an opportunity for the student to improve programming skills.

LEARNING RESOURCES

Pasahow, E.J. Microprocessors and Microcomputers for Eletronic Technicians, McGraw-Hill Ryerson, 1981.

Crawford, T. Basic Computing: A Complete Course, McGraw-Hill Ryerson, 1980.

Dwyer, T. and Critchfield, M. Basic and the Personal Computer, Addison-Wesley, 1981.

Dwyer, T. and Critchfield, M. A Bit of Basic, Addison-Wesley, 1981.

Horn, C. and Poirot, J. Computer Literacy: Problem Solving with Computers, Sterling Swift, 1981.

TOPIC 1: COMPUTER PROGRAMMING - INDUSTRIAL APPLICATIONS

GENERALIZATION: A coded language must be used so that the micro-computer can understand instructions given by the operator.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Storage and Retrieval	- write programs which will handle commonly used data in electronics and store it in memory - write a program which can be used to teach the use of a specific piece of electronic test equipment		
2. Problem Solving	- write a program which can be used to perform calculations commonly required in electronics, such as: - Ohm's Law - Kirchhoff's Law - circuit analysis problems		
3. Control	- write a program which will utilize the computer to control an external device through an IO port, such as: - an RS232 interface		
4. Simulation	- write a program which simulates an electronic circuit (Graphic representation should be considered)		

NOTES:

MODULE NINE

COMMUNICATIONS - INTRODUCTORY

INTRODUCTION

This module will provide the opportunity to learn the theory of amplification.

OBJECTIVES

The objectives of the Communications - Introductory module are to:

1. Familiarize the student with the theory of amplification.
2. Give the student the opportunity to practise using electronic test equipment.
3. Give the student the opportunity to build an amplifier.

TOPIC 1: AMPLIFICATION

GENERALIZATION: Amplification is an important aspect of electronic communication and is an integral part of home entertainment systems.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Amplifier Circuits	- construct a simple amplifier using a breadboarding system, or equivalent, and discuss the principle of operation		
2. Limitations	- experiment with frequency response, power handling and distortion present in the system to establish the limitations of the amplifier		
3. Variations	- use different inputs, to check system performance, such as: - microphone - cassette - turntable - A.M. tuner - F.M. tuner		
4. Advanced Audio Systems	- discuss, pseudo quadraphonic and quadraphonic systems under the following: - operating system - performance - cost		
5. Performance	- use a basic amplifier system, add a tone control unit and check the performance		
6. Impedance	- experiment with matched and unmatched impedances in input and output and discuss the results		

NOTES:

MODULE TEN

COMMUNICATIONS - SYSTEMS

INTRODUCTION

This module will introduce electromagnetic waves as carriers of communications and provide an opportunity to study the various integrated sub-systems.

OBJECTIVES

The objectives of the Communications - Systems module are to:

1. Give the student the opportunity to become familiar with the circuitry used in the generation, modulation, transmission, reception and detection of electromagnetic waves.

2. Introduce the student to the theory of radio communication.

LEARNING RESOURCES

Telecommunication Regulation Circulars, 24 and 25.
Dept. of Communications, Edmonton.

Extracts from General Radio Regulations Parts 1 and 2
Dept. of Communications, Edmonton.

New General Radio Service Handbook
Dept. of Communications, Edmonton.

All of the publications listed are available free.

TOPIC 1: RADIO COMMUNICATION IEERC

GENERALIZATION: Radio and television communication equipment originally developed for industrial communication is now often used for home entertainment.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Principles of radio tansmission	- describe how a radio wave is transmitted - discuss the simple radio transmitter		
2. Principles of radio reception	- operate a radio receiver and discuss the function of: - RF tuning section - local oscillator - IF section - detection section - amplifiers - power supply		
3. RF Oscillator	- experiment with a radio frequency oscillator		
4. Transmission:			
- modulation methods	- discuss various methods of adding information to carrier signals: - CW - AM - FM - SSB		
5. Receiving:			
- detection	- discuss the detection of radio frequency carriers and the methods used in demodulation		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
6. Applications	- using a radio system as a means of communicating audio information discuss how RF carriers are: - generated - transmitted - received - demodulated		
7. Television	- using a television system as a means of communicating audio and video information discuss how the RF carriers are: - generated - transmitted - received - demodulated		

NOTES:

MODULE ELEVEN

ELECTRONIC DESIGN

INTRODUCTION

This module will give the student practice in planning and organizing an electronic project for construction.

OBJECTIVES

The objective of the Electronic Design module is to:

1. Give the student the opportunity to design an electronic project which satisfies established performance parameters.

TOPIC 1: ELECTRONIC SYSTEM DESIGN IEEED

GENERALIZATION: An electronic system should be designed to perform effectively and efficiently within established parameters.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:		
1. Planning	- decide on a specific electronic system to be designed - check the symbols for the various electronic components - make a circuit drawing of the system		
2. Parameters	- examine the system and establish: - function - size of the system - safety considerations		
3. Parts	- make up a parts list and determine the source for the components and the projected costs		
4. Prototype	- construct the system using breadboards and check that it meets the function requirements - design a component layout and check that the functional requirements are met - establish the wiring or circuit techniques to be used, such as: printed circuit or point to point		

NOTES:

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
5. Printed circuit	- design a printed board circuit and make a master for the system, if required - prepare solder resist drawings, if required - prepare silk screen master(s) for printed circuit boards		
6. Non-electronic parts	- establish cabinet, knobs, finish, etc. to be used in the construction of the system		
7. Assembly Manual	- prepare an assembly manual for the system showing: - pictorial drawings - step by step procedures		
8. Production Costs	- project the savings on the mass production of a large number of the systems, e.g. 1000 units		

NOTES:

MODULE TWELVE

ELECTRONIC CONSTRUCTION

INTRODUCTION

This module will familiarize the student with the logical and organized process involved in the construction of a functional electronic system.

OBJECTIVES

The objectives of the Electronic Construction module are to:

1. Familiarize the student with the tools and construction techniques used in the production of electronic systems.
2. Provide the opportunity for the student to follow a systematic approach to constructing an electronic system.

LEARNING RESOURCES

*Grob, G. Basic Electronics, McGraw-Hill Ryerson, 1977.

*Miller, Rex and Culpepper, Fred Energy: Electricity/Electronics, Gage Publishing Co.

*Refers to prescribed resources.

TOPIC 1: SAFETY IEEEC

GENERALIZATION: Safety is of prime importance to the well being of persons and the protection of equipment.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
	The student will:	4	O.H. & S. Films.
1. Unsafe Act	- list the consequences of unsafe acts in Electricity-Electronics as they relate particularly to: - live circuits - excessive current - improper grounding - poor connections		O.H. & S. Posters. "Alive Personnel" "Electricity - Handle with Care" film avail. from Power Co.
2. Unsafe Condition	- discuss how to identify conditions which could lead to injuries		
3. Safety Standards and Codes: - Federal - Provincial - Local	- discuss safety standards and codes - perform experiments in compliance with the electrical code		IAVEC - ATA Safety Pub. See Unsafe Acts and Conditions IAVAC - ARA Reference to publication on safety.
4. First Aid	- study the correct procedure to remove a person from a line and administer artificial respiration - study the symptoms and treatment for a person in shock		First Aid Films. St. John's Personnel. Fire Dept. Personnel
5. Safety Program	- participate in the prescribed safety program of the lab and/or school system		

NOTES:

TOPIC 2: CONSTRUCTION TECHNIQUES IEEEC

GENERALIZATION: When constructing electronic systems an organized and logical procedure should be observed.

CONCEPTS/SUBCONCEPTS	LEARNING TASKS	HOURS	REFERENCES
1. Construction Techniques	The student will: - use the predetermined technique for the circuitry being used in the electronic system and assemble all components - use acceptable testing techniques to trouble shoot and check the operation of the completed system		

NOTES:

GENERAL

1. Research Module

The purpose of the Research Module is to allow individual students to engage in an in-depth study of a problem related to any of the career fields.

The time period is 25 hours and qualifies as a regular module.

The module provides for individualizing the program to allow for special interests of students. The student should prepare a proposal of his/her research and have it approved by the teacher. The proposal should contain:

a) A statement of the problem.

b) The procedure to be followed in the research of the problem.

c) A list of the materials and lab facilities to be used.

d) A time line of activities.

2. Developmental Module

The purpose of the Developmental Module is to provide a 25-hour block of time for the teacher to try out new content with his/her class. The content of the proposal or project should be discussed with the Associate Director of Curriculum for the Practical Arts.

3. Production Science Module

The purpose of Production Science is to provide for a class project in setting up a company to produce a product or service.

The teacher may select content from the Production Science 30 curriculum guide. The Production Science 30 course will provide an outline from which content may be selected to develop a 25-hour module. The Production Science 30 is a full 4-5 credit course so the teacher must be selective in choosing the content for a module.

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